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Factors influencing the success of BOT power plant projects in China: A review

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ABSTRACT

The rapid economic growth in China has created massive demand for power generation facilities. Build–operate–transfer (BOT) concessions have been granted to attract foreign and private investment. Interest in the BOT scheme for power plant projects has been growing rapidly. BOT projects normally involve a number of parties and usually face a number of constraints. The identification of key factors for Chinese BOT projects helps to accomodate these constraints so that the expected project outcomes can be achieved. A multi-facet qualitative approach is adopted in this research to investigate the factors influencing the success of BOT electric power projects in China. The results showed that there are 14 factors at both macro level and micro level, affecting the success of Chinese BOT projects. The results indicate that the success of China's BOT electric power projects require a combined efforts from all related stakeholders. These findings provide a valuable reference for both policy makers and investors for the future BOT power plant developments in China.

Contents

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1. Introduction

In the past 30 years, China's rapid economy growth has resulted in an average gross domestic product (GDP) growth of 13% annually as shown in Fig. 1 [1]. Even though it was affected by major natural disasters and global financial crisis, China still achieves an annual GDP growth rate of 9% in 2008 [2]. Massive amount of electricity is required to fulfill demands derived from rapid economic growth In China, the demand for electricity is projected to grow by an average annual rate of 4.3% over the period to 2025 [3]. According to the International Energy Agency, Chinese annual electricity consumption will reach nearly 3 trillion kW h by 2020 [4]. Year 2010 added 92.31 million kW h to the total capacity of electricity, reaching 966.41 million kW h [5].

However, substantial capital requirement presents one of critical constraints for the development of power plants in China. As shown in Fig. 2, the investment on electric power increased from 134.4 billion RMB in 1995 to 1188.9 billion RMB in 2010 [6]. By the end of the "Twelfth Five-year period", the installed capacity of China's electric power industry will soar to 1437 million kW, which requires 5300 billion RMB of investment [7]. Indeed, incomplete financing system presents a significant challenge for renewable energy developments [8,9] and affects the project costs significantly [10,11]. As a result, build–operate–transfer (BOT) was introduced as alternative project financing model to motivate private participation in investment [12].

BOT projects in China have drawn attention from both academics and industry practitioners. This is evidenced by a number of papers published in academic journals, professional magazines and books. However, there are limited studies specifically focusing on the BOT electric power sector in China. The aim of this study is to identify factors influencing the success of BOT power plant projects in China. This analysis will assist both the foreign investor and the private sector to make decisions on bidding such projects and to adapt themselves so that exceptional project outcomes can be achieved.

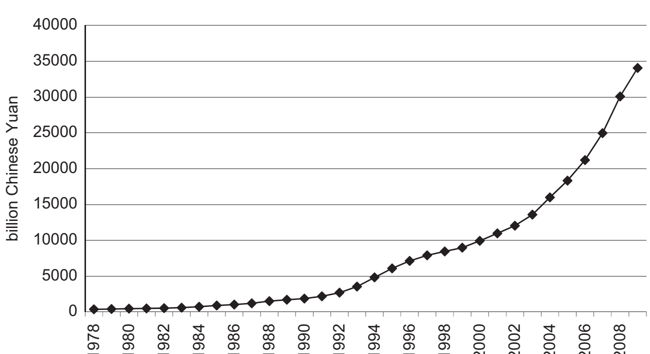

Fig. 1. China's gross domestic product (GDP) growth (1978–2009).

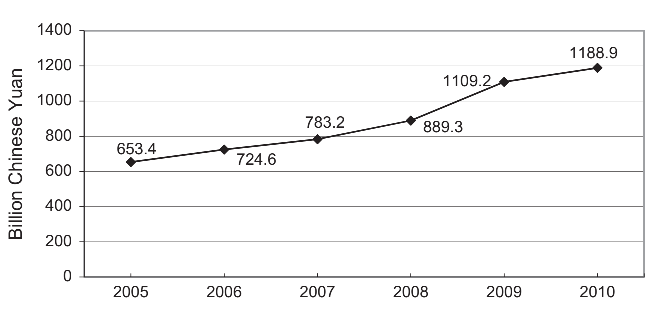

Fig. 2. Investment on electric power in China (2005–2010).

2. Research methodology

A multi-facet qualitative approach is adopted in this study to identify a list of factors critical for BOT power plant projects in China. The study unfolds in a combination of literature survey, review of case study reports and interviews.

2.1. Literature survey

An extensive review of relevant literature was conducted. These include the following three sources:

- Research papers. A systematic search was carried out in major databases by using keywords such as "Build–Operate–Transfer", BOT, critical success factors, risks and performance indicators to search relevant papers that were published 1999–2011. Chinese academic databases were also searched for the local publications.
- Statistical data. The statistical data are retrieved from China Statistical Yearbooks (1996–2010) and International Energy Agency.
- Policy documents. The policy reports include various official reports and regulations published recently by major government authorities including China Energy Development Report, China Insurance Regulatory Commission Ministry of Commerce, Ministry of Finance and State Administration of Taxation, State Council, National Development and Reform Commission and State Administration of Foreign Exchange.

2.2. Review of case study reports

Case studies reports of five typical BOT power plant projects that distribute in five different provinces. They are: Shajiao B power plant (Guangdong provience), Laibin B power plant (Guangxi autonomous region), Zhonghua power plant (Shandong province), Changsha power plant (Hunan province), and Huangqiao power plant (Jiangsu province). These selected case studies reports provide valuable information of BOT practice in China.

2.3. Semi-structured interviews

The objective of interviews is to test the literature survey findings and to develop a framework of factors influencing the success of BOT power plant projects in China. A total of 37 semi-structured interviews were carried out with a range of selected practitioners involved in the Chinese electric power engineering industry. The interviewees were selected from Government officials (11%), Electric power firms (21%), Design institutes (22%), Contractors (24%), Consulting firms (15%) and Financial institutions (7%). All interviews have extensive experience in the electric power industry and BOT related experience.

3. Results

The analysis of the data collected in literature surveys, case study reports review and interviews highlighted a list of 14 factors influencing the success of BOT power plant projects in China. These factors are classified into two levels, i.e. macro level and micro level (project level).

3.1. Macro level

3.1.1. Local economy development level

The local economy development level usually determines whether or not it is necessary to undertake a BOT power projects. Most BOT power plants were built during the period of time expecting serious electricity generation shortages [13]. Yuan et al. pointed out that the project necessity is crucial to the success of the BOT power plant projects in China [14]. A typical case is the Shajiao B power plant project which is built in 1988 as the first ever BOT project in China. The Shenzhen Power Development Company (SPDC) provides land and water resources while the Hong Kong Hopewell Holdings Limited (HKHHL) is responsible for the project financing, construction and operation. During that period of time, the local economy is growing rapidly which creates massive demands for electricity. However, the local electric power industry was so underdeveloped that it was not able to fulfill the electricity demands. There was a shortage of fund and there was no system yet in place to attract the foreign fund. All these factors made it necessary to build a new power plant with the financial input from the private sector.

There is an imbalanced distribution of the energy resources in China. Basically the western region has abundant energy resources. However, due to historic reasons, there was no infrastructure in place to transport these resources to those regions with energy demands. A BOT proposal is more likely to be approved if the project is located in a region with a high level of economic development [15]. Comparing a variety of current BOT projects, Chen and Messner concluded that the BOT approach is viable in the East and Coastal areas where the investment environment is favorable and the local economy is more developed [16].

The global financial crisis results in the economy slowdown. According to the State Council of China, nearly half of the announced stimulus package (valued 4 trillion Chinese Yuan) will be spent on highway and electric power projects [17]. The State Council specified in the Twelfth Five-Year Plan that non-fossil fuel will account for more than 11% of total primary energy consumption by 2015 [18,19]. The new and renewable energy developments (e.g. hydropower, nuclear power, biomass power) have been defined as a key measure for emission reduction in the recent announced ''Comprehensive work plan of energy conservation and emission reduction during the Twelfth Five-Year period'' [20]. The total production value of the energy conservation and environmental protection sector will reach 3 trillion RMB by year 2015. Therefore, a lot of opportunities exist for foreign investors and domestic private sector to have more involvement in China's BOT electric power projects, in particular new and renewable energy developments.

3.1.2. Public acceptance

Public perception, awareness, attitude, behavior and acceptability should be taken into consideration seriously in renewable energy projects [21,22]. Public acceptance or rejection poses a critical risk to BOT projects and should be dealt with at the design stage [23]. According to interviewees, public recognition is one of critical success factors for China's BOT power plant projects. As infrastructure projects, BOT power plant projects have to serve the public. All the activities of the public sector should represent the willingness of the people, obtain the consent of the public, and reflect the public preferences for the public interest. Therefore, the involvement of the general public is crucial. As one interviewee stated, ''…the higher level of public participation, the lower level of project risks, the higher chance for the project to be successful''. Accordingly, the public participation should commence from the feasibility study phase and be maintained across the project life cycle. Zhang also revealed that the acceptability to the local community is a significant risk associated with Chinese BOT projects [24]. In fact, BOT power plant projects in China are required to make the information related to environmental impact assessment available to the public for feedbacks.

3.1.3. Environmental regulations

There is a growing attention from both the government and the public on the environmental issues associated with electric power developments [25]. Risks exist in Chinese BOT power plant projects due to associated environmental impacts. The Chinese government has released a series of environmental legislation and policies in order to address these issues properly. All new-built power plants have to take environmental protection requirements fully [26]. China has devoted to promote the BOT power projects with high efficiency and low pollution [27]. Indeed, all BOT power plant projects in China have to satisfy the environmental impact assessment by the independent organization.

The standards related to atmosphere quality and wastewater treatment are likely changing in different stages of BOT power plant projects [24]. Zhao et al. pinpointed that the consequence of ignorance of these issues is severe, e.g. heavy penalties, increasing costs and suspension of development process [28]. This is further reinforced in the ''Comprehensive work plan of energy conservation and emission reduction during the Twelfth Five-Year period'' which clearly stipulated that the total SO_2 emission will be reduced to 20.86 million tons in 2011, 8% lower than the level of year 2010. Severe penalty will be applied to those enterprises such as thermal power plants that generate excessive pollutants [20].

3.1.4. Political stability

Thomas et al. proposed a framework to assess key risks associated with BOT projects based on a fuzzy-fault tree and the Delphi method where ''loss due to adverse government decisions/policies'' is identified as one key risk [29]. China is no exception. The political risk is one of significant risks in China's BOT projects [30]. Interviewees emphasized that the stability of the political environment and the overall credit rating of the host government are the top factors to be considered prior to the decisions whether or not to invest from the equity investors point of view and whether or not to provide loan from the lender. China's stable political environment is one of success factors attract the foreign investment in power plant projects.

Although BOT approach has been introduced into China for over 20 years, the soundness of the legislative framework for BOT projects is still in doubt. The legal basis which steers the BOT investment mainly refers to those special rules during the development of pilot BOT projects, particularly the BOT circular issued in 1995. These circulars only set out the terms in principle for the establishment of the project company, the approval procedure and the government guarantee. Weakness of these circulars is quite obvious.

Similarly, policy continuity is crucial for the sustainable development of BOT power plants. Chen and Messner revealed that the policy adjustment in the energy sector, compounded by the seasonal dropping demand of electricity has introduced significant difficulties to close the financial arrangement in the Changsha Power Plant Project. The Shandong Zhonghua power plant project experienced similar issues. Due to the reform of China's electricity sector, the Shandong Power Group, the biggest shareholder of the Zhonghua power plant project, was divided into two corporations. The Shandong Guodian Group was set up in charge of power plants and the Shandong Power Grid was merged into the North China Power Grid. This affected not only

the governance of the project but also the execution of the power purchase agreement. One example given by interviewees with respect to the policy continuity is the export rebate for purchase of domestic equipment by foreign investors. In China, the State Administration of Taxation issued the Administration of Tax Rebates on the Purchase of Domestically-Manufactured Equipment by Foreign Investment Enterprises Trial Procedures on 20 September 1999. Eligible foreign investors can apply for tax refund to encourage the use of domestically-manufactured equipment in projects [31]. However, the Ministry of Finance and the State Administration of Taxation jointly issued The Circular concerning Stopping Export Rebate for Purchase of Home-made Equipment by Foreign Investors on 25 December 2008 to replace the previous policy. Foreign investors will continue to receive tax refunds for purchasing domestic equipment until June 30, 2009, when certain conditions are met [32]. Indeed, the regulatory framework on renewable energy plays a critical role for optimizing the structure of power generation in China [33].

Based on the study of Shajiao B, Laibin B and Changsha BOT power projects, Jing (2002) emphasized the importance of the stability and continuity of policies during the project period [34]. Apart from issuing relevant laws and regulations, an effective administration adjudication system is required to ensure their implementation and to enhance the transparency of the law enforcement [34]. The electricity pricing system also affects the affordability of renewable energy and hence the public acceptance [35].

As a long-term investment, any change on the industrial policy and investment guideline brings significant risks to BOT projects [36]. The Government should design different industrial policies and investment guidelines to regulate the foreign investment in different periods or different sectors.

3.1.5. *Legal landscape*

In recent years, China has issued a series of laws such as Law of Commercial Banks, Insurance Law and Guaranty Law. These laws play an active role to create a macro environment which is conducive for the project financing. So far, however, there are not specialized BOT legal documents.

A well established legal framework for the regulation of agreements and enforcement of contracts is required to endure legal and regulatory transparency [37]. Chen and Doloi identified the opaque and weak legal and regulatory system as a significant factor impeding the BOT application in China [38].

There are ongoing financial sector reforms where the ongoing market liberalization will allow for greater foreign bank participation in Chinese domestic currency finance. Trial Measures for the Administration of the Indirect Investment of Insurance Capital in Infrastructure Projects is effective March 6, 2006 [39]. In addition, The Implementing Regulations of the Enterprise Income Tax Law of the People's Republic of China is effective January 1, 2008. All enterprises engaged in power plant projects can enjoy the tax concession of 3 years exemption plus 3 years taxation at 50% of the full tax rate [17].

Catalogue for the Guidance of Foreign Investment Industries, effective on December 1, 2007, continues to provide a generally-favorable framework for foreign investment in many types of infrastructure projects. The involvement of foreign investors in the construction of electric power grid is moved from the prohibited category (which was defined in the previous version in 2004) to encouraged category [40]. Ministry of Commerce also issued the Guidance Opinions on Foreign Investment to encourage international cooperation in clean development mechanism projects [41].

This assessment and approval system for power plant project required the project funds to be confirmed during the feasibility study phase. In other words, the project developer and the potential investors have to go through the tedious procedure prior to the final approval and confirmation of the project. This to a certain extent hinders the application and promotion of BOT approach in China. Interviewees also emphasized that more efforts need to be made on improving the efficiency of the approval process by the government.

According to Yeo and Tiong, it is hard to achieve a risk-return trade-off in BOT power projects in China without government support [42]. The interviewees refer to a successful BOT project where the local government assists the project company to secure the all approvals that are necessary for the construction, operation and maintenance of the project. The project company is also guaranteed to obtain the exclusive Land-Use Right for the project site. Meanwhile, the local government assists the project company to have the import tariff approval for the equipment and materials that will be imported from overseas. Furthermore, the local government promises not to approve other similar projects in the same region.

The return on investment (ROI) is one critical issue in BOT projects [34]. A guarantee to ROI will significantly motivate the foreign investor and operator to reduce the cost and enhance the profit [34]. However, State Council of China issued The Notice on Questions related to the Appropriate Management of Existing Projects with Guaranteed Returns for the Foreign Investor in September 10, 2002. It clearly stipulated that any "guaranteed return" clauses should be deleted as this arrangement does not comply with the relevant laws and regulations on foreign investment projects [43]. The deletion of these clauses helps to form a healthy investment environment where the foreign investor and the Chinese party share benefits and risks fairly. In 1990s, some local governments took the advantages of autonomy to attract the foreign funds by promising high ROI rate. An example is Jiangsu Huangqiao thermal power plant project, which is financed via BOT. It is clearly defined in the contract that the amount and price of electricity produced by the Huangqiao plant are fixed. The ROI of the first two years are as high as 34.5% whist the average ROI in the 20 years' concession period reaches 25.5%. This ROI is much higher than the usual rate of 12%. However, this forecast is too optimistic without a comprehensive consideration of risks. In fact, the power plant was in debt trouble due to the changes to the policies.

3.1.6. *Economy policy*

The major task of a BOT project is to raise funds. Financing presents a significant challenge to renewable energy developments [44,45]. As interviewees stated, the success of a BOT project is determined by whether or not identifying an appropriate equity investor and the lender who are willing to provide the full funds. It is relatively easier to secure the lender and the investor in a country with a developed banking system and financial market. In most BOT projects, the project company will receive the payment in the form of local currency. A certain percentage of this payment needs to be converted to foreign currency for the repayment purpose and profits. It is comparatively easier to develop BOT projects in those countries without both excessive inflation and high exchange rate fluctuations. Otherwise, even though the host government is willing to protect the investors from the inflation and foreign exchange risk, foreign and private investors are reluctant to show interest in BOT projects in such unstable financial environment.

The majority of revenues from investing in Chinese power projects is in Chinese currency for foreign investors where a large

proportion of this revenue will be exchanged for repayment to foreign lenders [46]. At present, the Chinese capital market is far from perfection. The fluctuation of loan interest rate and foreign exchange rate present a significant risk to BOT projects in China [47]. The financing channels mainly rely on commercial banks. Without clear policies, the banks lack of enthusiasm to provide loans to BOT project, which limits the capability of the private capital in BOT projects.

Chinese financial market should be improved by allowing the private sector to raise funds by means of security, investment funds and trust. Meanwhile, the relevant authorities should establish the enterprise credit database and the enterprise credit evaluation system so that those enterprises with economic efficiency and high credit rating can take this advantage against competitors. The market can then play the fundamental role in allocating financial resources to ensure the smooth investment channels in BOT projects.

State Administration of Foreign Exchange of China newly issued the Circular on Foreign Currency Capital of Foreign-Funded Enterprises in August 29, 2008 to reinforce China's policies on stemming the inflow of "hot money" through foreign-invested enterprises. This circular sets up a clear procedure for foreign exchange conversions into Chinese currency [48]. For instance, foreign exchange capital of a foreign-invested enterprise cannot be converted into Chinese currency until the capital has been verified by a local accounting firm. In the Hainan Qinglan power plant project, the provincial government coordinated various authorities to deal with the assurance issues associated with foreign exchange for the project developer, e.g. the right of foreign currency conversion.

3.1.7. Credit regulations

Lack of creditworthiness could jeopardize viability of the project [49]. The success of Chinese BOT projects also relies on the reliability and creditworthiness of Chinese entities, such as contractors, partners, suppliers and lenders that have agreement with foreign parties [16,50].

The significant risks associated with BOT power projects in China can be managed via a series of financing documents and credit guarantee agreement. Different contract documents should be designed to deal with different risks. For instance, signing the energy and raw materials supply agreement can warranty the supply with stable price. Furthermore, the project company needs to maintain an appropriate project funding mechanism and a sound bidding process [51]. A proper risk management strategy, featured with well-designed concession period and effective incentive schemes provides a 'win–win' solution for both project developer and the host country government [52].

From the supplier's perspective, the credit worthiness of the purchaser is critical as well. Interviewees commented that the credit system has been improved in past decade however the government authorities should be more proactive to maintain and further improve the credit system. A healthy credit system will assist the supplier to check the credit worthiness of the purchaser transparently, which in turn helps to improve the project efficiency. In some Chinese BOT power plant projects such as Shajiao B, the government issued a support letter to the project developer which helped to enhance its credit for financing purpose.

3.2. Micro level (project level)

3.2.1. Project profitability

The host country government should make efforts to assess the financial viability prior to attempting to finance new infrastructure projects through private sector participation [53]. In the Laibin B project, the financier was recognized as one of most critical stakeholders as specified in the concession agreement. The financier was involved in the business negotiation and was one of signees of the arbitration agreement. Ozdoganm and Birgonul pointed out that BOT is not viable unless the project is clearly capable of generating revenues so that the lenders can be satisfied with the cash flow of the project [54]. A successful BOT power plant project should be financially attractive [51]. It can be two-folded. The first aspect of the financial attraction of the project is the expected profitability of the project. A power plant project with no or less profit is not attractable to the private sector. Another aspect of the financial attraction of the project is the expected debt paying ability of the project [29,55]. In a BOT electric power project, the project developer (the project company) normally borrows money from banks or financial institutions. The ability of the project to pay debt is one of key considerations for the private investors. This is reflected in all case study reports that were accessed in this study.

Interviewees also pinpointed that the financial performance of the BOT power plant project is heavily determined by its profitability and debt paying ability. These are two of most critical factors taken into consideration by the bank or financial institution when making the decision whether or not to provide loan for the project. For instance, in the Shajiao B project, the Guangdong provincial government guaranteed to purchase a certain amount of electricity at the pre-defined tariff. Without this agreement, the expected profitability and the expected debt paying ability of the project will be affected significantly.

3.2.2. Technology complexity

According to interviewees, the maturity of the technologies adopted is likely to affect the success of BOT power plant projects in China. Project developer usually is reluctant to choose a complex and immature technologies. Indeed, complexity of technologies is one of critical factors that affect the construction cost [56] and the decision of adopting innovations to tackle climate change [57]. Therefore, expert judgment should be sought to examine the suitability of technologies adopted in the project.

3.2.3. Project developer's business capacity

According to interviewees, the business operation capacity of the developer is critical to the success of BOT projects in China. A sound bidding process and procedures should be in place to select the project company (developer) with the required capacity. According to the practice and the experiences collected from Chinese BOT projects such as the Laibin B power plant, the minimum electricity price can be obtained via a competitive bidding process, which helps to improve the economic efficiency of the project. A set of bidding evaluation system should be established to conduct comprehensive assessment and prediction of the effectiveness of the optimized configuration of resources and capital. For instance, the selection criteria used in the Laibin B power plant include: on-grid electricity price (rather than merely focusing on the return of investment), costing, extent of using foreign capital, technical performance, safety performance, environmental performance, and resource utilization. Similarly, the incentive mechanisms play a crucial role to ensure the project performance. In the Laibin B project, the project developer is required to provide bidding bond of US $10 million, performance bond of US $30 million, and operation & maintenance bond of US $15 million during the different project stages. The bond will not be released until the previous stage is completed as per the contract specification. These effective mechanisms guaranteed the successful implementation of BOT process in the Laibin B power plant.

Not surprisingly interviewees emphasized the crucial role of financing management in BOT projects. BOT projects are featured with long project period and a huge amount of investment. In addition, the large sums of money will be spent periodically according to the project schedule. Therefore, the level of financial management of the project company is particularly important so that funds can be disbursed continuously and effectively according to the project progress.

3.2.4. Project developer's management capacity

A typical BOT electric project involves a number of contracts, e.g. loan, design, procuring, construction, operation and maintenance contracts. Level of contract administration capacity is highlighted by interviewees as one of success factors for BOT power project in China.

The past decade has witnessed the transition of the procurement of Chinese infrastructure from exclusive negotiation to international competitive bidding. According to Chen and Messner, most BOT project will be acquired via open or selected bidding in the future [16]. The procurement process should be improved by means of standardizing tender documents and maintaining competitive environment for best offer [14].

Braadbaart et al. studied five BOT projects contracts in China. They found that there is lack of contract specifications such as: plant design defects and environmental liabilities, and commercial risks (e.g. interest rate and exchange rate fluctuation) [58]. These present significant risks to BOT projects. Wang et al. asserted that the contract clauses adopted in the Laibin B power plant are relatively adequate in addressing the political risks however is not sufficient to deal with risks associated with approval delays, compensations and law changes [50]. As a result, the project developer should have to develop contract administration capacity to handle these risks.

All interviewees share the view that there are a number of risks associated with BOT projects so that a proper risk management mechanism needs to be in place. An efficient risk management framework is required to reduce negotiations prior to contract award and to minimize the risk of poor risk distribution [59,60]. These risks include: political risks, construction risks, operating risks, market and revenue risks, financial risks, and legal risks Wang et al. [46]. Therefore, the risk management skills and capacities of the project company will to some extent to determine the success of Chinese BOT projects.

According to interviewees, the competency of developer's personnel is particularly important for the success of a BOT project in China. The personnel should have not only the technical expertise but also knowledge on the local social-economic context. One of the common comments made by interviewees is that foreign developers should localize the human resources for undertaking BOT electric development in China. According to Zhao et al., competency of developer's personnel is more important in BOT wind power projects than in BOT thermal power projects [61].

3.2.5. Project contractor's capacity

As another key stakeholder, contractor plays a key role in Chinese BOT power plant projects as well. There are uncertainties with the construction completion, e.g. the cost, quality, scope and time. Therefore, the contractor's ability is crucial to the success of BOT projects [30]. During the bidding process, financial evaluation of bids should be based on an investigation of measures such as net assets, earnings and financial ratios including debt to equity, current ratio and ability to carry construction losses. Moreover, the business operation and qualification of contractors need to be taken into account.

Furthermore, the project management capacity, the track record in the similar projects, and the business operation and qualification of the contractor should be considered during the process of selecting bidder [62]. According to interviewees, the project contractor should have sufficient in-house resources (e.g. project management structure, human resources and quality management, construction equipment ownership) or is able to outsource these resources that are necessary for the proceeding of the project.

Risk-taking, information sharing and interpersonal skills are important for both project developers and contractors involved in Chinese BOT projects. The management of relations between the central government, local government and local banks needs to be paid special attention [63].

3.2.6. Project supplier's capacity

The supply of raw materials (e.g. the quality, price fluctuation and credibility of the supply) and the main equipment presents a significant risk to BOT power plant projects in China [24].

In general, China is still short of fuel resources. Interviewees commented that the fuel price will escalate with the demand of the market. The increase of the fuel price will result in the increase of the electricity price going into the grid whereas the electricity generating companies is not allowed to raise the electricity price. In other words, electricity generating companies bears the risk of fluctuation of the fuel price.

The supply of the major equipment is crucial to the success of BOT projects in China. Reliable equipment contributes to the stable operation and convenient maintenance of BOT power plant projects. On one hand, presently Chinese manufacturers have fallen behind in some aspects such as design of some key components. Lack of technological innovation and human resources has also chronically constrained the competitiveness of Chinese suppliers. One the other hand, to design and manufacture major equipment with high quality and lower cost has become one of the main driving forces for most Chinese manufacturers. With the rapid expansion of equipment manufacturing, R&D has been concerned more than before [64]. For example, the Ministry of Science and Technology of China listed the R&D on electric power manufacturing in its guidelines and will increase funding annually.

For introducing western advanced technology, it is a win-win strategy for both the Chinese and the overseas manufacturers to form Sino-foreign joint venture. The joint venture combines the overseas advanced technology with lower production and assembly cost in China. For example, some interviewees revealed that joint venture manufacture in China can reduce costs of producing a turbine-generator unit by some 20% compared to that importing from overseas.

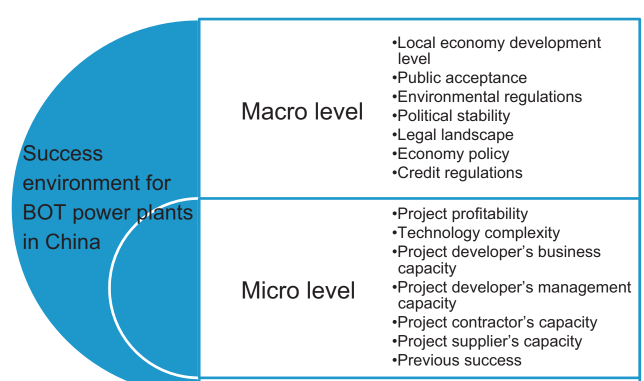

Fig. 3. Success environment for BOT power plants in China.

3.2.7. Previous success

Majority of interviewees commented that the previous successful BOT power plant projects, particularly in the same region or nearby help to motivate more BOT projects. The main metrics of BOT project success are defined by interviewees as: completion on time, electricity generation and connecting to grid on time, no major environmental issues or social issues, creation of new employment opportunities to the local community, etc. In particular, one government interviewee revealed that his department has streamlined the approval procedure for all aspects of renewable energy projects via BOT approach following the successful implementation of two power plants via the same approach Fig. 3.

4. Conclusions

Chinese economy has achieved enormous growth in past decades and people's living condition is constantly improving. Electricity shortage is one significant barrier which hinders the further development of the economy and fulfilling social requirements. Since 1985, the Chinese electric power industry has gone through a dramatic reform and development. The monopoly of solely state fund in electricity generation is terminated as a result of a transition from the planned economy to the market economy. The emergence of the foreign and domestic private equity funds plays a key role in the development the power plant projects. A number of preferential policies have been issued to attract the foreign investors and the domestic private sector to the electric power sector. Laws and legislations are also established to regulate the involvement of non-government fund in this industry. In addition, the political and social environment is stable and the investment environment continues to improve. All these factors gain the confidence of foreign investors to invest in China.

This paper adopted a qualitative approach to form a framework of the factors influencing the success of the Chinese BOT power plant projects. This research highlighted 14 factors at two levels, i.e. macro level and micro level. In general, opportunities and risks co-exist in China's BOT power plant projects. The success of the project relies on the combined efforts from various parties and the focus on those factors identified in this study. This result offers assistance to the foreign investor and the domestic private sector to make the decision of bidding BOT power plant projects in China and to develop the strategies to steer these projects towards success.

The limitation of this study belongs to its explorative nature. Further research opportunities exist to conduct in-depth investigation of project financing in electric power projects in China via a case study approach, and to differentiate the strategies for the foreign investors and domestic private sector for participating BOT projects in China. Similarly, it is worth investigating analytical relations between various factors via quantitative approaches such as the Analytic Hierarchy Process (AHP).

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